**Title:** RESILIENTED PISTON IN THE INTERNAL COMBUSTION ENGINE

**Abstract**

In a four-stroke internal combustion engine an elastic or telescoping link is provided between the piston crown and the crank shaft (5) whereby, at the completion of the exhaust stroke, the piston crown is able to extend its travel towards the cylinder head (2) thereby expelling substantially all combustion products from the working space (22). The link may be a compression spring (17) or telescoping members located between the piston and connecting rod (8), between sections of a multipiece piston (12, 13) or between the small end and big end of the connecting rod (8). The elastic or telescoping link has application in reciprocating, rotary or orbital piston engines.
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"Resiliented Pisten in the Internal Combustion Engine"

5 TECHNICAL FIELD

The invention pertains to improvements of internal combustion engines whether with a reciprocating or rotary or orbital piston at which is solved more complete displacement of combustion gases from the cylinder before a fuel-air mixture is sucked or filled in.

BACKGROUND ART

Disposition of the hitherto known internal combustion engines enables displacement of such quantum of combustion gases which by own cubic capacity equals to exhaustion stroke of the piston. This is because the exhaustion stroke equals to the compressive one that is why after exhaustion stroke always remains just such quantum of combustion gases which by own undiluted volume equal to cubic volume which is necessary for compression of the fuel-air mixture in the cylinder.

The defect consist in that the fuel-air mixture is always sucked or filled up to a remainder of combustion
gases into the cylinder which substantially depreciates ready fuel-air mixture to compression and it does not only make perceptible aggravation for ignition or ignition by compression but it especially reduces effect of expansion, alias it reduces efficiency of the internal combustion engines.

DISCLOSURE OF INVENTION

In contrast to the existing stage of the technics higher effect is attained by a resilient piston in an internal combustion engine in accordance with the invention.

Basic principles of the invention are equipment of a piston assembly by a resilient mounting;

disposition of the cylinder and of the piston which are made so that they enable to reduce the exhausting space to the project minimum at the moment of completion of exhaust stroke when the resilient mounting is not weighted by compression pressure and is extended to its maximum size;

and a compression space made by reaction of compression pressure on the piston with completion of compression stroke whereby the resilient mounting is
pressed and it is the consequence of the piston's subsidence in the cylinder for creating of the essential space to compression of the fuel-air mixture.

5 The resilient mounting, putting together an internal part of the piston and an external part of the piston or the small end and the big end of a connecting rod or through a gudgeon pin the piston and the connecting rod, which is either a spring resilient mounting or a telescopic one, made so that it is automatically extended to its limit size when the piston is not weighted by compression pressure, and is contracted to its limit size before or when the project compression pressure is reached in the cylinder.

10 By activity of the resilient mounting is reached a better displacement of combustion gases from the cylinder and strengthening up to automatic regulation of the compression of the fuel-air mixture in the cylinder. Owing to the better displacement of combustion gases there is reached a reduction of the fuel-air mixture from the combustion gases. Together it increases ignitability or ignitability by compression and amplifies an expansive force in the cylinder or, in other words,
the invention increases efficiency of the internal combustion engines.

BRIEF DESCRIPTION OF DRAWING

The invention is illustrated diagrammatically in the accompanying drawing by way of examples. The diagram illustrates only the principles of the invention. It is therefore to be understood that the invention is capable of numerous modifications and variations apparent to those skilled in the art without departing from the spirit and scope of the invention.

Figure 1 is a diagrammatic cross-sectional view of the part of a four-cycle internal combustion engine, in the concrete of the part concerning a cylinder block, the part concerning a cylinder head assembly, the four piston assembly, the part concerning of a crankshaft, and the part concerning a crankcase.

All cross-section surfaces are demarcated by bold line and hatched, only the slight particles are indicated by one bold line. Connections of mains which are not evident from cross-section they are indicated by thin lineal lines.

Illustrated state is at a dead centre position wherein the pistons are at the extremes of their travel.
BEST MODE OF CARRYING OUT INVENTION

Figure 1 shows the best mode of carrying out the invention. The diagrammatic cross-sectional view of the part of the four-cycle internal combustion engine comprises

- a cylinder block with four cylinders 1;
- a cylinder head 2 with an exhaust valve 3 and with an inlet valve 4 for every cylinder 1;
- a crankshaft 5 with bearing shells 6;
- four piston assemblies;
- and a crankcase 7.

The piston assembly comprises a connecting rod 8 with a bearing cap 9, a gudgeon pin 10 with two circlips 11, and the piston.

The piston comprises an internal part of the piston 12, an external part of the piston 13, and a resilient mounting.

The one-piece internal part of the piston 12 is formed from a barrel side-piece and from a ring rib. The barrel side-piece of the internal part of the piston is furnished by two opposite centre holes 14 for the gudgeon pin 10, which is assured by two circlips 11 there. The ring rib, which reinforces the internal part of the piston 12, is
furnished by a round dimple. The round dimple is a bed for the resilient mounting. A centric space of the ring rib is for the small end of the connecting rod to its pendulum movement there.

5 The external part of the piston 13, which is resiliently jointed with the internal part of piston 12, is equipped with a ring equipment 15, and with a flange 16. The barrel side-piece of the external part of the piston on its open part is thinned inside for putting the internal part of the piston 12 there and for equipage of the external part of the piston by the flange 16. The flange 16 prevents the internal part of the piston 12 and the external part of the piston 13 from getting out from their reciprocal joint. The length of the thinning of the barrel side-piece to the flange 16 limits the stretchiness and the shrinkage of the resilient mounting.

The resilient mounting, which resiliently the external part of the piston 13 from the internal part of the piston 12, comprises a coil spring 17, and a ring spring seat 18.

20 The bed of the coil spring is the round dimple in the ring rib which prevents the coil spring 17 from the movement to side. The ring spring seat 18 prevents the external part of the piston 13 from the frictioning by the coil spring
17. The resilient mounting is automatically extended to its maximum size when the piston is not weighted by compression pressure and is contracted to its minimum size before or when the project compression pressure is reached in the cylinder 1.

Diagram of Figure 1 is also a graphic description of state with completion of every stroke from fourstroke-cycle: Completion of inlet stroke A, completion of compression stroke B, completion of expansion stroke C, and completion of exhaust stroke D.

During the time of inlet stroke, the resilient mounting is stretched to maximum size because on the head of the piston there is not an operation of compression pressure, but on the contrary a vacuum arises with suction in the cylinder 1. The suction space created with completion of inlet stroke A and in this time it is a real volume of the cylinder.

With compression stroke the resilient mounting is pressed in dependance on the growth of compression pressure in the cylinder 1. With the completion of compression stroke B, the resilient mounting is pressed to its limit shrink, provided that there is a sufficient
sucked quantum of the fuel-air mixture. In dependance of a quantity of sucked fuel-air mixture into cylinder 1, the compression space 20 can be slightly decreased if the resilient mounting has strengthened the compression stroke.

With the completion of expansion stroke C, depression of the resilient mounting is dependent upon the expansion force. If the expansion force is sufficient, there results an elongated expansion stroke or, in other words, there is created a maximal expansion space 21 in the cylinder 1.

The spontaneous extension of the resilient mounting comes when the expansion pressure after explosion ceases to be effective. The reduced exhausting space 22 is created when the completion of exhaust stroke D, is reached.

All the elements of the cylinder head assembly which could be in the way of the piston they are sunk into the cylinder head 2. It must be kept in mind especially that with the completing of exhaust stroke, the exhaust valve 3 is now still opened a little, and it will close with the completion of exhaust stroke D.
INDUSTRIAL APPLICABILITY

The industrial exploitation of the invention is in the manufacturing of the above.
SUMMARY OF REFERENCE SIGNS

1 - CYLINDER
2 - CYLINDER HEAD
3 - EXHAUST VALVE
4 - INLET VALVE
5 - CRANKSHAFT
6 - BEARING SHELL
7 - CRANKCASE
8 - CONNECTING ROD
9 - BEARING CAP
10 - GUDGEON PIN
11 - CIRCLIP
12 - INTERNAL PART OF PISTON
13 - EXTERNAL PART OF PISTON
14 - OPPOSITE CENTRE HOLE
15 - RING EQUIPMENT
16 - FLANGE
17 - COIL SPRING
18 - RING SPRING SEAT
19 - SUCTION SPACE
20 - COMPRESSION SPACE
21 - MAXIMAL EXPANSION SPACE
22 - REDUCED EXHAUSTING SPACE

A - COMPLETION OF INLET STROKE
B - COMPLETION OF COMPRESSION STROKE
C - COMPLETION OF EXPANSION STROKE
D - COMPLETION OF EXHAUST STROKE
CLAIM

A resilient piston in an internal combustion engine characterized by

a resilient mounting, putting together an internal part of the piston (12) and an external part of the piston (13) or the small end and the big end of a connecting rod or through a gudgeon pin (10) the piston and the connecting rod (8), which is either a spring resilient mounting or a telescopic one made so that it is automatically extended to its maximum size when the piston is not weighted by compression pressure and is contracted to its minimum size before or when the project compression pressure is reached in the cylinder (1);

and by a reduced exhausting space (22) with completion of the exhaust stroke (D) when the resilient mounting is extended to its maximum;

and by a compression space (20) which is made by a reaction of compression pressure on the piston with completion of the compression stroke (E) whereby the resilient mounting is pressed and it is the consequence of the piston's subsidence in the cylinder (1).
INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 83/00129

I. CLASSIFICATION OF SUBJECT MATTER
According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl. 3 F02B 29/00, 75/04, 75/38

II. FIELDS SEARCHED
Minimum Documentation Searched

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<td>IPC</td>
<td>F02B 29/00, 75/04, 75/36, 75/38</td>
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<td>US Cl.</td>
<td>123/78A, 123/78E</td>
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Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched

AU: IPC as above; Australian Classification 64.2, 66.2; Digest of US Patents 1789-1905 compiled by James T. Allen

III. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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<tr>
<th>Category</th>
<th>Citation of Document, 13 with indication, where appropriate, of the relevant passages 14 Relevant to Claim No. 15</th>
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<td>X</td>
<td>US, A, 1385758 (SCHULTZ) 26 July 1921 (26.07.21) (1)</td>
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<td>X</td>
<td>US, A, 1406886 (NUTA) 14 February 1922 (14.02.22) (1)</td>
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* Special categories of cited documents: 13

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IV. CERTIFICATION

Date of the Actual Completion of the International Search 1

12 December 1983 (12.12.83)

Date of Mailing of this International Search Report 8

16 December 1983 (16.12.83)

International Searching Authority 4

AUS Patent Office

Signature of Authorized Officer 19

A. A. Moore

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**FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET**

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**V. OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE**

This international search report has not been established in respect of certain claims under Article 17(2) (b) for the following reasons:

1. **Claim numbers****** because they relate to subject matter not required to be searched by this Authority, namely:

2. **Claim numbers****** because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

**VI. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING**

This International Searching Authority found multiple inventions in this international application as follows:

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

**Remark on Protest**

- The additional search fees were accompanied by applicant’s protest.
- No protest accompanied the payment of additional search fees.